

# APPENDIX A

## HYDROLOGY AND HYDRAULICS

### WEST FORK TRINITY RIVER BASELINE CONDITIONS MODEL

The Baseline Conditions hydraulic model used in this study is the current Corridor Development Certificate (CDC) model for the West Fork of the Trinity River. The model uses 2050 flood event discharges. The CDC Model was originally developed using the backwater program HEC-2 Water Surface Profiles. The model was subsequently converted to HEC-RAS River Analysis System version 3.0.

“The CDC Manual and Program affirm local government authority for local floodplain management while establishing a set of common permit criteria and procedures for development within the Trinity River Corridor.”<sup>1</sup> The Trinity River Steering Committee, consisting of local elected official from jurisdictions in the Trinity River Corridor, approved the first edition of the CDC manual 23 May 1991. Within the next two years, the participating communities (Arlington, Carrollton, Coppell, Dallas, Farmers Branch, Fort Worth, Grand Prairie, Irving, Lewisville) officially amended their floodplain ordinances to adopt the CDC common permitting criteria and process. In the CDC process, the CDC model is considered the design model for proposed development projects in the Trinity River Corridor. The CDC Model was developed as part of the Upper Trinity River Feasibility Study (UTRFS). The CDC Model is the design model used for analysis of proposed floodplain development projects within the Upper Trinity River corridor.

The original CDC West Fork hydraulic models were developed by extensive use of digitized 2-foot contour interval topography. The topographic data was developed from February/March 1991 aerial photography. The majority of the cross-section data was supplied by the surveying contractor and generated from the topographic data, with cross-sections locations developed by the U.S. Army Corps of Engineers. Additional cross-sections were developed in-house from the topographic files and included in the models as necessary. Other information used in the development of the models originated from bridge plans, bridge surveys, field reconnaissance, and levee surveys. Channel data originated from 1975 field surveys. Aerial photographs and field reconnaissance were used to determine roughness coefficients. The West Fork Trinity River CDC Model limits: from the West Fork/Elm Fork confluence to Lake Worth Dam (58.08 miles).

The Baseline Conditions model incorporates recent modifications to the Fort Worth Floodway (from 4<sup>th</sup> Street to Riverside Drive), and modifications from Riverside Drive to Beach Street performed by the Tarrant Regional Water District (TRWD), the local sponsor of the Fort Worth Floodway – a federal flood control project. The modifications included channel and bank excavation operations from the 4<sup>th</sup> Street Dam to Beach Street, which has resulted in an increase of conveyance for flood events within the Fort Worth Floodway. The TRWD also constructed two channel dams: the 4<sup>th</sup> Street Dam – a roller-

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<sup>1</sup> Corridor Development Certificate Manual – 2<sup>nd</sup> Edition 1998

compacted concrete dam, crest elevation 500.5, located at river station 2294+62, length 284 feet, and the Beach Street Dam - a roller-compacted concrete dam, crest elevation 494.5, located at river station 2177+58, length 244 feet, pool created upstream to the 4<sup>th</sup> Street Dam. This project reach has been reviewed by the U.S. Army Corps of Engineers under the CDC program. The project was determined to meet the applicable CDC hydrologic and hydraulic criteria.

## PROJECT REACH

The project reach limits are within the West Fork Trinity River reach from East 1<sup>st</sup> Street (river station 2063+40) to Riverside Drive (river station 2228+97). IH 30 forms the southern boundary of the reach. Riverside Drive is the downstream limit of the Fort Worth Floodway - a federal flood control project. The oxbow is the original West Fork river channel. In the 1970's the TRWD constructed a cutoff channel, which extended from Riverside Drive to downstream of Beach Street. The work consisted of removing obstructions, and realignment and enlargement of the effective river channel. Other features within the project reach include the new West Fork/Sycamore Creek confluence (created during the original TRWD work), Beach Street roadway with the West Fork main bridge and oxbow culvert, Gateway Park, and an abandoned sewage treatment plant. The upstream end of the oxbow is plugged - backwater from the West Fork enters the oxbow from the downstream end. The industrial/commercial area to the north drains into the oxbow.



### Oxbow channel

The localized drainage area into the oxbow covers 2.07 square miles (about 1300 acres). Its predominant stream path tracks southward from near the Mount Olivet Cemetery (located at the southwest corner of the intersection of NE 28th Street and Sylvania Avenue) to the old Trinity River channel, from whence it proceeds in an easterly direction past Beach

Street, to its confluence with the current Trinity River channel. The overall source stream length is approximately 3 miles and the centroid of the watershed is located about one third of this distance (from the outlet end). The weighted slope of this source stream is approximately 21.3 feet per mile (0.4 percent). The watershed is heavily urbanized with predominantly single-family residential structures. The surface soils are generally sandy in nature.

Standardized analyses for peak flows (tabulated in cubic feet per second units) and pool elevations (feet NGVD) from hypothetical storms produced the following results shown in Table A-1.

**TABLE A-1  
OXBOW LOCAL DISCHARGES/ELEVATIONS**

|                     | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR | 500-YR |
|---------------------|------|------|-------|-------|-------|--------|--------|
| Inflows             | 1000 | 1900 | 2400  | 2900  | 3300  | 3700   | 4400   |
| Outflows            | 500  | 900  | 1200  | 1500  | 1600  | 1800   | 2000   |
| Peak Pool Elevation | 496  | 500  | 502   | 504   | 506   | 507    | 510    |

The flood hydrograph attenuation reflected herein results from the temporary storage of these floodwaters in a long, slender pool area in the old Trinity River channel, upstream from the Beach Street crossing. The significant degree of attenuation is due to the fact that these floodwaters must be passed via a relatively small (12-foot diameter) round concrete pipe at the base of the Beach Street embankment and due to the fact that the old Trinity River channel provides a substantial storage volume in comparison to the contributing drainage area.

Under existing conditions, localized inflows during storm events rapidly accumulate in the old Trinity River channel and these stored floodwaters are gradually emptied over several hours. Only the somewhat restricted opening at the Beach Street crossing provides for any significant degree of detention time in the old river channel. Floods sourced along the Trinity River also impact the old river channel. A comparison of peak pool elevations (in feet NGVD) from hypothetical storm events (both localized and more so regional) are provided in the Table A-2.

**TABLE A-2  
OXBOW ELEVATIONS/TRINITY RIVER ELEVATIONS**

|                        | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR |
|------------------------|------|------|-------|-------|-------|--------|
| From Localized Inflows | 496  | 500  | 502   | 504   | 506   | 507    |
| From the Trinity River | 506  | 512  | 514   | 516   | 518   | 519    |

The above-tabulated values from the Trinity River relate to the tailwater elevations that develop at the unrestricted mouth of the oxbow. Backwater profiles along the Trinity River increase slightly (by about one foot) over the length of the oxbow reach, but the terrain separating the two bodies of water (i.e. the north bank of the current Trinity River channel) is generally elevated enough to maintain full separation for floods having

recurrence intervals of 5 years (or less). Flood-producing thunderstorms in this region can occur at any time during the year, but are generally more common in the late spring, early summer, and early fall months. A review of National Weather Service data recorded at the Dallas-Fort Worth International Airport since 1974 indicates the following distribution of annual rainfall (in inches). Precipitation data are shown in Table A-3. A portion of the annual precipitation falls slowly enough to preclude any significant runoff. In order to generally reflect equivalent runoff that might be anticipated, a column was included in this table, identifying the average number of occurrences of daily storms in excess of one half inch in depth, in an annual cycle.

**TABLE A-3  
PRECIPITATION DATA**

| Month     | Average<br>Precipitation<br>Depth | Average Number<br>of Occurrences of<br>Daily Depths Greater<br>Than One Half Inch |
|-----------|-----------------------------------|---|
| January   | 1.93                              | 1.15  |
| February  | 2.47                              | 1.70  |
| March     | 3.12                              | 2.26  |
| April     | 3.19                              | 2.37  |
| May       | 5.35                              | 3.81  |
| June      | 3.28                              | 2.48  |
| July      | 2.02                              | 1.45  |
| August    | 2.02                              | 1.19  |
| September | 2.33                              | 1.56  |
| October   | 4.02                              | 2.52  |
| November  | 2.60                              | 1.78  |
| December  | 2.54                              | 1.74  |
| Annually  | 34.88                             | 24.00   |

At the subject project site, localized runoff of one-half inch relates to an equivalent flood hydrograph volume of approximately 55 acre-feet. It should be noted that the above-tabulated occurrences include many instances of rainfall depths ranging from a few to several inches. As such, total equivalent volumes should not be inferred from this specific tabulation.

Similar investigations were made regarding the likelihood of having sufficient streamflow along the Trinity River, for sustaining any proposed wetland cells and/or an impounded oxbow reach. The following table summarizes the median (50-percent reliable) and 90-percent reliable streamflows (in cubic feet per second), based on statistical evaluations on data recorded at the U.S. Geological Survey (USGS) gage located downstream of the confluence of the Clear Fork and West Fork of the Trinity River (specifically at Nutt Dam), located a few river miles upstream from the study area. Table A-4 summarizes the West Fork Trinity River streamflow data.

**TABLE A-4**  
**WEST FORK TRINITY RIVER STREAMFLOW DATA**

| Month     | Median Daily Streamflow | 90-Percent Reliable Daily Streamflow |
|-----------|-------------------------|--------------------------------------|
| January   | 36                      | 15                                   |
| February  | 46                      | 17                                   |
| March     | 67                      | 16                                   |
| April     | 77                      | 16                                   |
| May       | 159                     | 15                                   |
| June      | 56                      | 8.8                                  |
| July      | 27                      | 5                                    |
| August    | 19                      | 5                                    |
| September | 22                      | 5.7                                  |
| October   | 25                      | 8.9                                  |
| November  | 27                      | 10                                   |
| December  | 35                      | 13                                   |
| Annually  | 50                      | 11                                   |

Table A-5 includes the West Fork of the Trinity River Baseline Conditions flood event discharges within the project reach. Figure A-1 shows the 100-year flood event and SPF event water surface profiles in the project reach.

Streamflow gaging records published by the U.S. Geological Survey (USGS) for the station West Fork Trinity River at Beach Street were examined during this analysis. This particular gaging station is conveniently located within the subject project area. Records at this station are available beginning in Water Year 1977. The following table summarizes all of the identified flood hydrograph peaks:

| Water Year | Date         | Peak Discharge (cfs) | Water Year | Date        | Peak Discharge (cfs) |
|------------|--------------|----------------------|------------|-------------|----------------------|
| 1977       | 27 March     | 18800                | 1989       | 13 June     | 23800                |
| 1978       | 28 May       | 2590                 | 1990       | 02 May      | 46600                |
| 1979       | 03 May       | 14400                | 1991       | 12 April    | 9210                 |
| 1980       | 29 September | 6480                 | 1992       | 20 December | 36100                |
| 1981       | 09 May       | 7960                 | 1993       | 14 December | 11900                |
| 1982       | 13 October   | 26700                | 1994       | 19 October  | 9430                 |
| 1983       | 14 June      | 5320                 | 1995       | 06 May      | 13700                |
| 1984       | 8 October    | 8120                 | 1996       | 12 July     | 3240                 |
| 1985       | 22 April     | 6250                 | 1997       | 19 February | 20800                |
| 1986       | 24 May       | 9700                 | 1998       | 16 March    | 26800                |
| 1987       | 15 May       | 6170                 | 1999       | 30 May      | 11800                |
| 1988       | 01 June      | 5530                 | 2000       | 04 June     | 22900                |

2001 16 February 16500

The published mean daily flow data was used to determine approximate duration times over which the following frequency-related peak discharges were exceeded.

| <b>Water Year</b> | <b>Date</b> | <b>Peak Discharge (cfs)</b> | <b>Approximate Recurrence Interval (years)</b> | <b>Duration Over Which Flow rate Exceeded "2-Year" Peak Discharge (13,200 cfs) (days)</b> |
|-------------------|-------------|-----------------------------|--|---|
| 1977              | 27 March    | 18800                       | 3.3  | < 1   |
| 1979              | 03 May      | 14400                       | 2.2  | < 1   |
| 1982              | 13 October  | 26700                       | 5.9  | 5   |
| 1989              | 13 June     | 23800                       | 4.7  | 7   |
| 1990              | 02 May      | 46600                       | 24   | 18  |
| 1992              | 20 December | 36100                       | 12   | 7   |
| 1995              | 06 May      | 13700                       | 2.1  | < 1   |
| 1997              | 19 February | 20800                       | 3.9  | 1   |
| 1998              | 16 March    | 26800                       | 5.9  | 1   |
| 2000              | 04 June     | 22900                       | 4.4  | < 1   |
| 2001              | 16 February | 16500                       | 2.8  | (published data not yet available)  |

| <b>Water Year</b> | <b>Date</b> | <b>Peak Discharge (cfs)</b> | <b>Approximate Recurrence Interval (years)</b> | <b>Duration Over Which Flow rate Exceeded "5-Year" Peak Discharge (24,800 cfs) (days)</b> |
|-------------------|-------------|-----------------------------|--|---|
| 1982              | 13 October  | 26700                       | 5.9  | < 1   |
| 1990              | 02 May      | 46600                       | 24   | 5   |
| 1992              | 20 December | 36100                       | 12   | < 1   |
| 1998              | 16 March    | 26800                       | 5.9  | < 1   |

| <b>Water Year</b> | <b>Date</b> | <b>Peak Discharge (cfs)</b> | <b>Approximate Recurrence Interval (years)</b> | <b>Duration Over Which Flow rate Exceeded "10-Year" Peak Discharge (33,800 cfs) (days)</b> |
|-------------------|-------------|-----------------------------|--|--|
| 1990              | 02 May      | 46600                       | 24   | 1  |
| 1992              | 20 December | 36100                       | 12   | < 1  |

The design of the proposed Riverside Oxbow Project is such that flood events will not be significantly affected either in terms of discharges, depths, or durations. Furthermore, inundation durations at the project site are generally short enough that no detriment to existing and/or proposed additional vegetation is anticipated.

## **FORT WORTH FLOODWAY**

### **Authorization**

The completed flood control project was authorized by Section 2 of Public Law No. 14, 79<sup>th</sup> Congress, 2<sup>nd</sup> Session approved March 2, 1945.

### **Location**

The completed flood control work is located on the Clear Fork and West Fork of the Trinity River in Fort Worth, Tarrant County, Texas.

### **Description of Project**

The completed project consists of channel improvements, construction and strengthening of levees, installation and modification of drainage structures, modification of highway and railroad bridges, road relocations, and sodding and seeding of embankment and channel slopes, on the West and Clear Forks of the Trinity River between river mile 551.45 and 570.40, and river mile 0.00 and 7.57 respectively.

Approximately 57,300 linear feet of levee strengthening and 49,700 linear feet of new levee construction was accomplished on the West Fork and Clear Fork. The freeboard on the levees was provided at four feet above the design water surface. The Fort Worth Floodway design discharges are 95,000 cfs on the West Fork downstream of the West Fork/Clear Fork confluence, 50,000 cfs on the West Fork upstream of the West Fork/clear Fork confluence, and 75,000 cfs on the Clear Fork. These discharges are equivalent to the Standard Project Flood (SPF).

The Fort Worth Floodway experienced record flows in May 1990. The Clear Fork peak discharge was 17,500 cfs and the West Fork peak discharge downstream of the West Fork/Clear Fork confluence was 36,000 cfs.

The project includes 30 sumps to accommodate interior drainage. Each sump contains a concrete structure with a gravity sluice, consisting of a flap gate(s) and manually operated gate(s).

### **Protection Provided**

The project, in conjunction with Benbrook Reservoir, was designed and constructed to provide the leveed area of the city of Fort Worth a high degree of protection against possible future high water stages on the Clear Fork and the West Fork of the Trinity River.

### **Dates of Construction**

Work was initiated on the Fort Worth Floodway on 18 July 1950 and completed (except for turfing on the Clear Fork) on 15 July 1970.”

Local interests first constructed a system of levees in Fort Worth in 1910. The flood of 1922 overtopped the levees and the levee height was increased when repairs were made shortly thereafter. Failure of the levee system during the flood of 17 May 1949 confirmed the necessity for strengthening and extending the floodway. This began the federal participation on the Fort Worth Floodway.

**TABLE A-5  
WEST FORK TRINITY RIVER  
CDC MODEL FLOOD EVENT DISCHARGES (CFS)**

| <b>Location</b>                   | <b>1 year</b> | <b>2 year</b> | <b>5 year</b> | <b>10 year</b> | <b>25 year</b> | <b>50 year</b> | <b>100 year</b> | <b>250 year</b> | <b>500 year</b> | <b>SPF</b> |
|-----------------------------------|---------------|---------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|------------|
| West Fork u/s of Big Fossil Creek | 9400          | 13100         | 21700         | 27900          | 38700          | 52100          | 64700           | 83800           | 101900          | 148500     |
| West Fork d/s of Sycamore Creek   | 10800         | 15000         | 27000         | 36300          | 50700          | 64200          | 75300           | 95500           | 114200          | 158800     |
| West Fork u/s of Sycamore Creek   | 7500          | 10800         | 17800         | 24200          | 33200          | 43400          | 51700           | 69400           | 86600           | 129600     |
| West Fork d/s of Marine Creek     | 8600          | 12100         | 18800         | 24400          | 32400          | 40900          | 50500           | 68000           | 85100           | 122500     |
| West Fork u/s of Marine Creek     | 7300          | 10200         | 15600         | 21400          | 30800          | 39500          | 48400           | 65100           | 81500           | 118600     |
| West Fork at Fort Worth Gage      | 7400          | 10400         | 15800         | 21500          | 30800          | 39900          | 48700           | 65500           | 82000           | 118600     |
| West Fork u/s of Clear Fork       | 4900          | 7800          | 13500         | 14500          | 23200          | 28600          | 35400           | 45400           | 54700           | 59700      |
| West Fork d/s of Lake Worth Dam   | 4800          | 7800          | 13500         | 14500          | 23200          | 28600          | 35400           | 42500           | 54700           | 56400      |

**FIGURE A-1**  
**WEST FORK TRINITY RIVER**  
**WATER SURFACE PROFILES - BASELINE CONDITIONS**

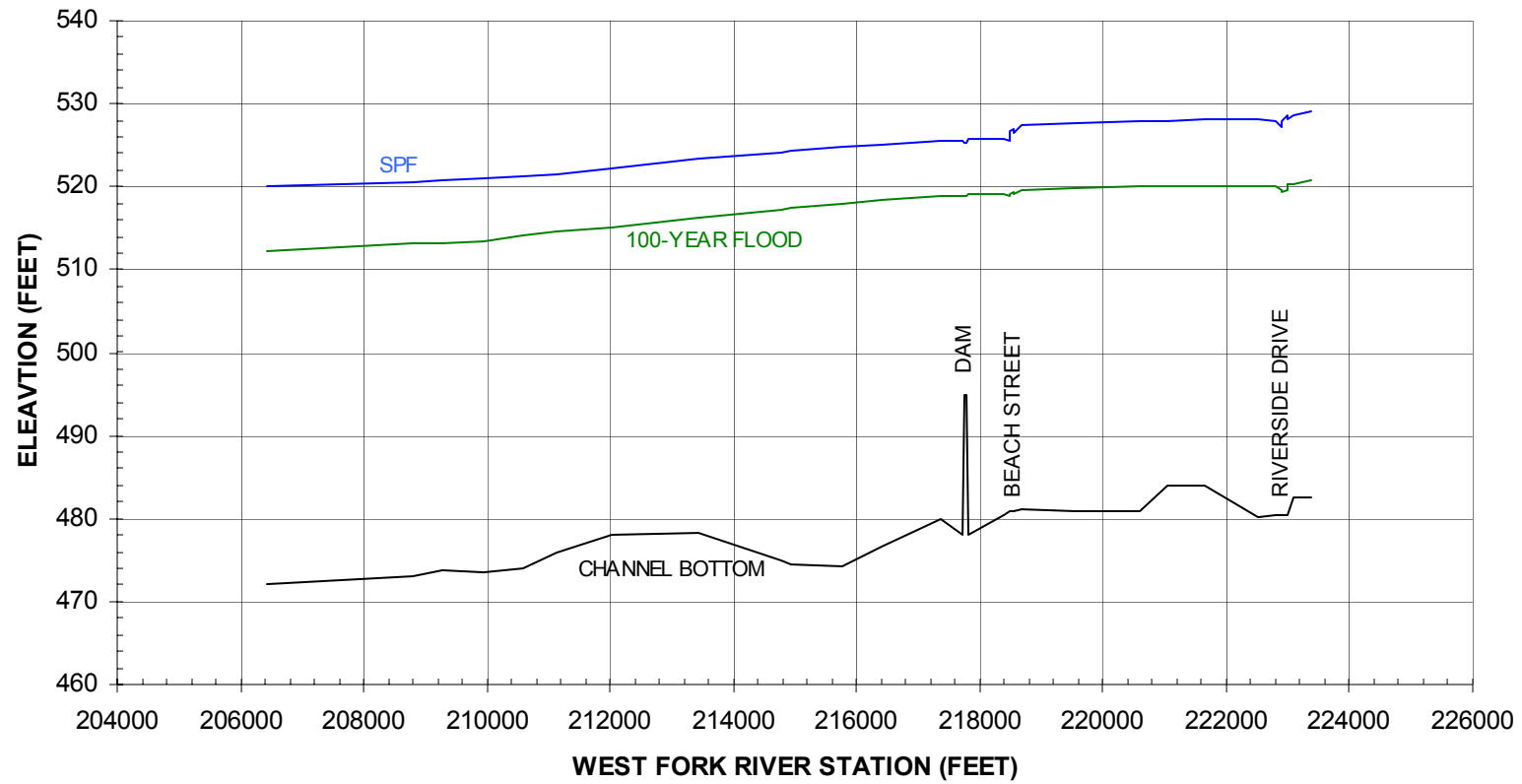
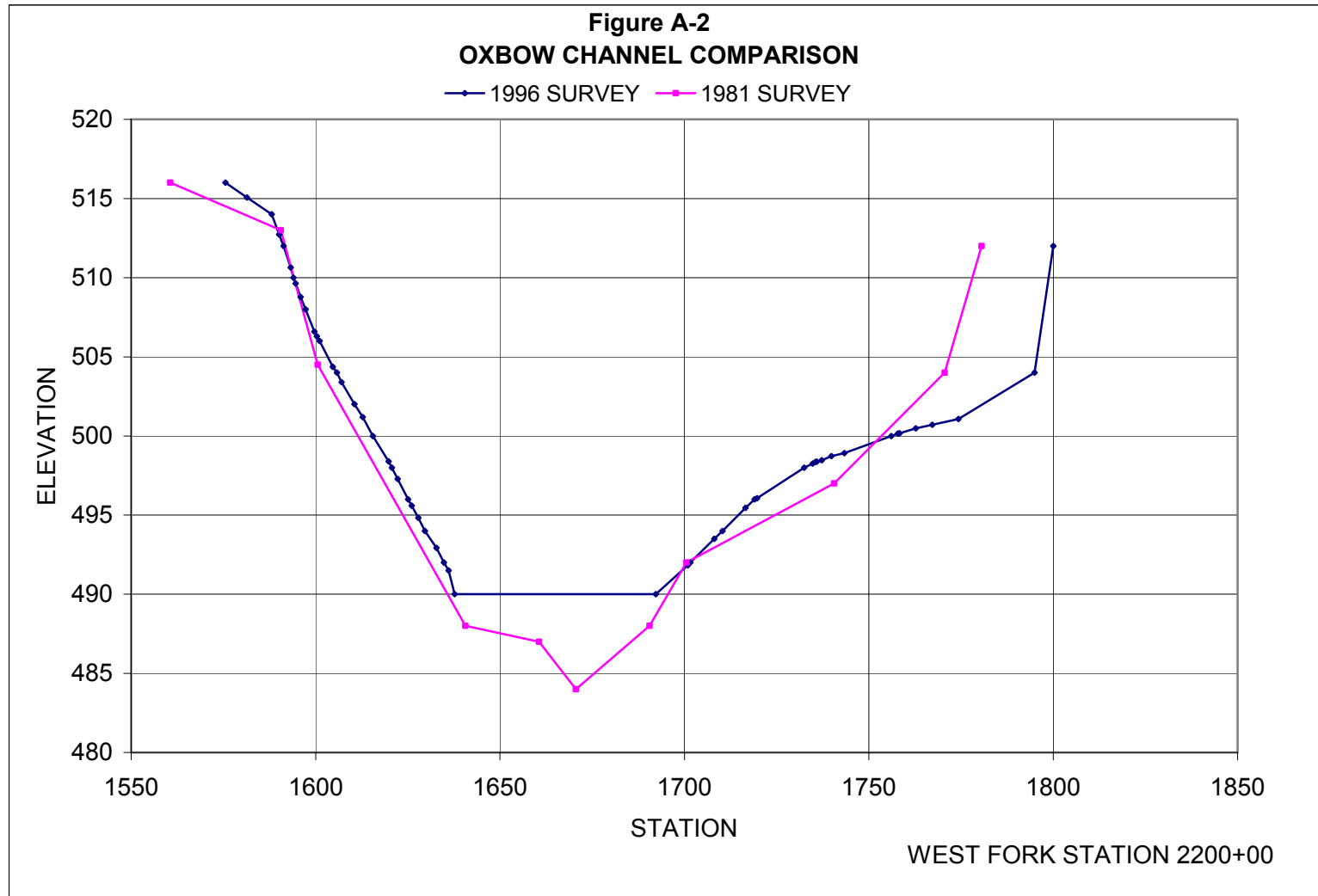
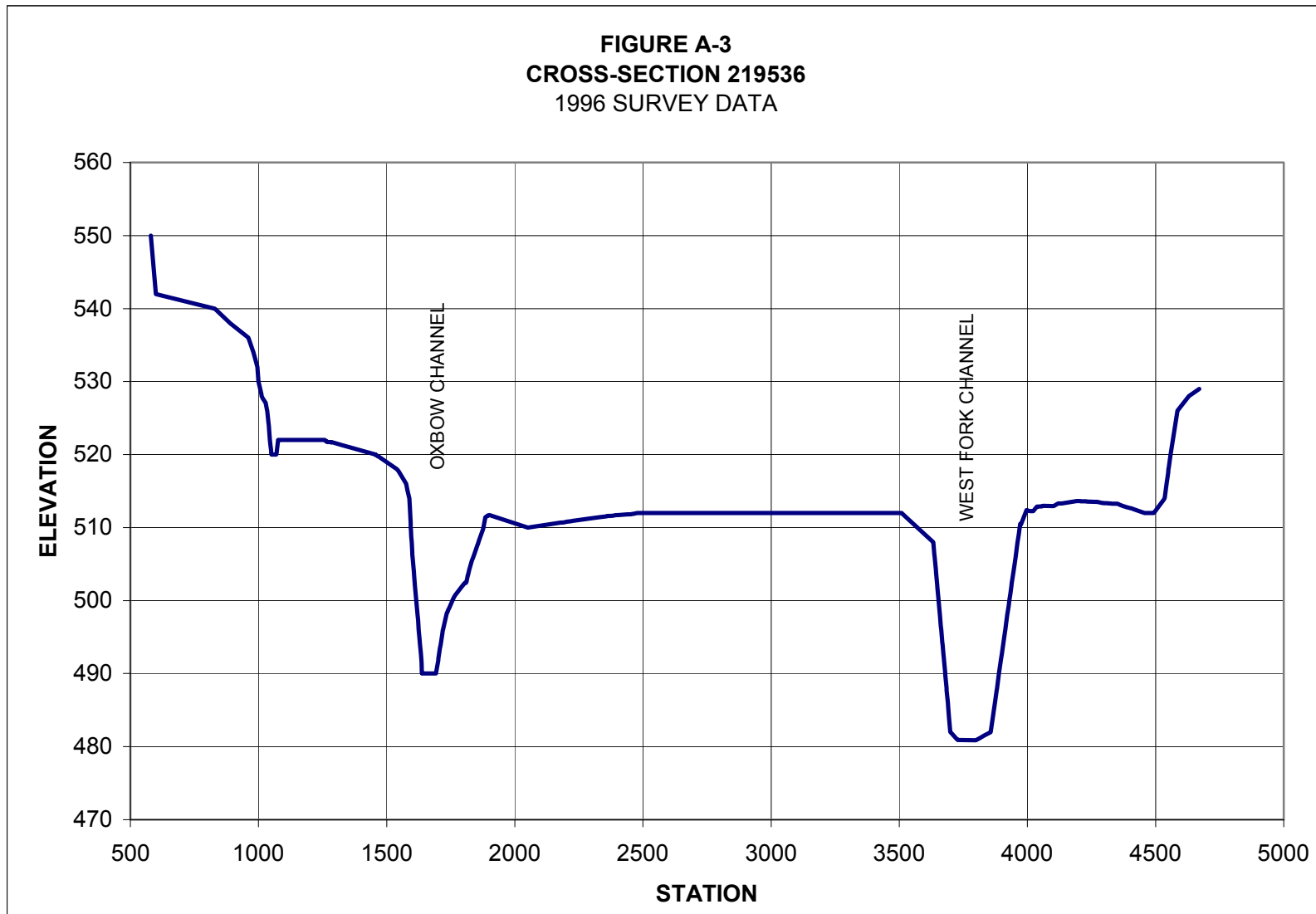


Figure A-2 represents a comparison of the Oxbow channel geometry at location (2200+00). The data sources are from a 1981 field survey and a 1996 field survey. The 1981 survey was completed less than ten years after completion of the new West Fork cutoff channel constructed by the TRWD.

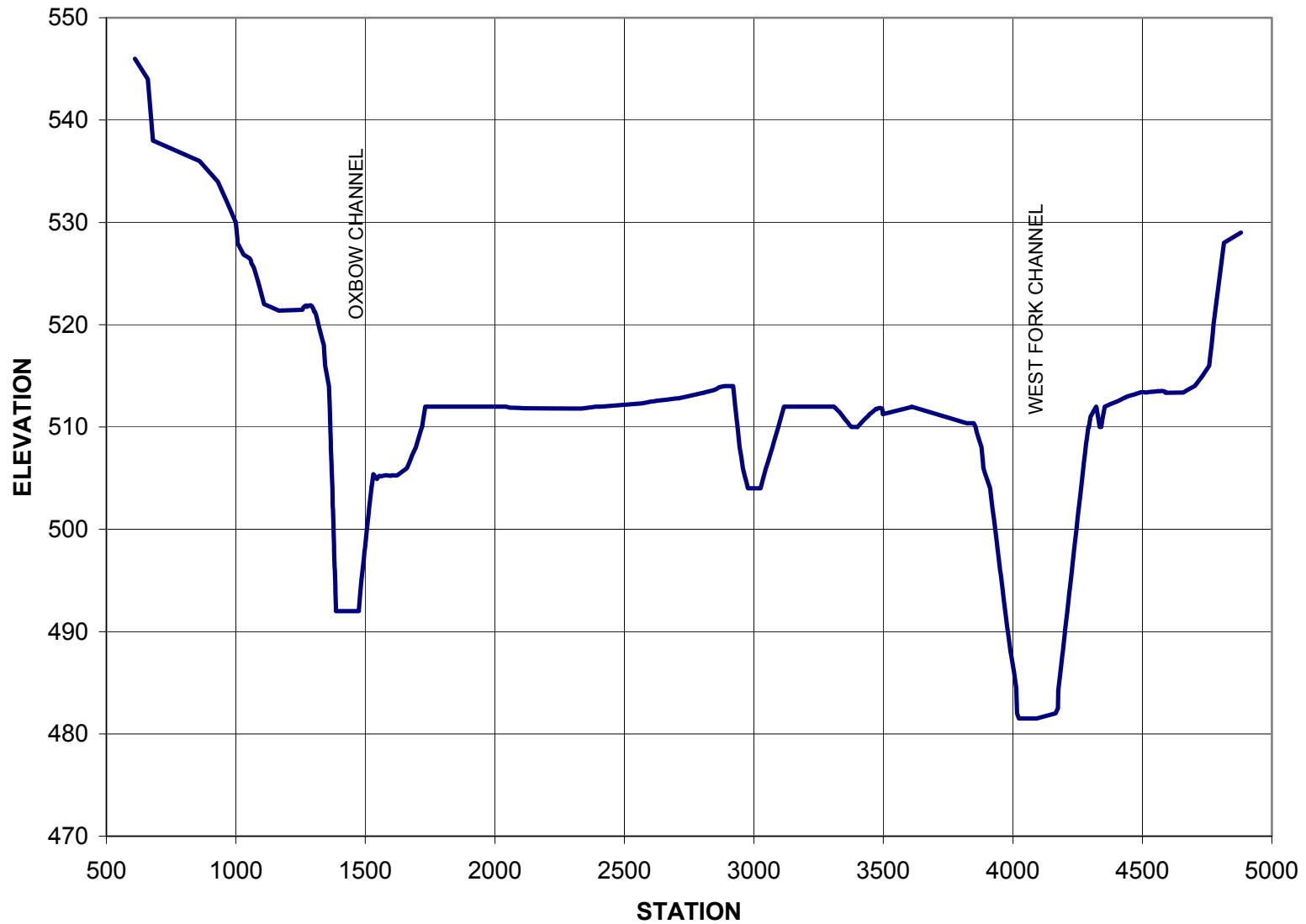




Figures A-3 and A-4 are cross-section plots of West Fork stations 2195+36 and 2205+94. The data is from a 1996 field survey. The plots indicate the Oxbow channel and the current West Fork river channel.



**FIGURE A-4**  
**CROSS-SECTION 220594**  
1996 SURVEY



## ALTERNATIVE PLANS

Two plans, the NER Plan and the LPP, were selected as the plans to be studied in detail. Each of the plans include common environmental and structural features: one low water dam located in the oxbow channel, tree planting, riparian corridor, building demolition, grassland planting, and wetland areas. The two plans are hydraulically equivalent in their effects on the West Fork floodplain.

A HEC-RAS backwater model was developed to represent the NER Plan. The major features of the project were represented in the model by Manning's coefficients of roughness (n values). The grassland area tree planting is a predominant feature of the NER Plan. The area that the proposed tree coverage density comprises within the grassland area was estimated at 10%. Accordingly the Manning coefficients of roughness used in the West Fork baseline conditions backwater model for the areas occupied by the grassland/trees features were increased using a weighted average method to represent the additional roughness due to the tree planting. The Manning coefficients of roughness used in the analysis are as follows:

- grasslands/trees: 0.059 – 0.135
- riparian corridor: 0.180
- riparian edge: 0.080
- wetlands: 0.050

The results of analysis are as follows:

- 100-year flood event: up to 0.25 feet increase
- SPF event: up to 0.31 feet increase

To mitigate for the increase in water surface elevations, a channel modification was developed to create additional conveyance. The channel modification limits are from river station 2164+00 to 12177+70. The entire modification is located downstream of the Beach Street Dam. The channel specifics are as follows: trapezoidal shape, grass-lined, 1V/3H side slopes, bottom width of 125 feet. Total excavation is approximately 100,000 cubic yards. Additional field cross-section surveys of the river channel in this reach are necessary to better define channel geometry, channel alignment, and excavation quantities. The water surface elevation increases in the 100-year flood and SPF were mitigated with the modified channel as part of the plan.

The proposed low water dam is located within the oxbow channel. The dam will be a compacted earthen dam. A control structure, consisting of a stop log structure, will be incorporated in the dam to control the upstream impoundment elevation as required. The normal pool elevation of the oxbow impoundment formed by the proposed dam will be approximately 493.0 feet, the same approximate elevation as the Beach Street Dam control elevation, which forms the West Fork river impoundment. The upstream plug at the oxbow will be removed and a clear span bridge will be constructed for maintenance purposes. The elevation-volume-area figures for the oxbow impoundment are indicated in Table A-6.

**TABLE A-6**  
**OXBOW IMPOUNDMENT DATA**

| Impoundment<br>Elevation<br>(feet) | Impoundment<br>Volume<br>(acre-feet) | Impoundment<br>Area<br>(acres) |
|------------------------------------|--------------------------------------|--------------------------------|
| 490                                | 4.1                                  | 4                              |
| 491                                | 9.1                                  | 7                              |
| 492                                | 17.1                                 | 9                              |
| 493                                | 28.0                                 | 12                             |
| 494                                | 41.0                                 | 14                             |

The oxbow impoundment formed at the normal pool elevation of 492.0 is approx. 17.1 acre-feet. This volume is considered a decrease in the available valley storage within the West Fork floodplain, since the impoundment occupies valley storage available for a flood event in baseline conditions. Therefore mitigation for the 17.1 acre-feet is required within the study area.

A plan, which both diverts flow into the oxbow and includes provisions for impoundment of floodwaters in the old Trinity River channel, has been investigated in significant detail during the plan formulation phase. Two potential dam sites were considered, one immediately upstream from the Beach Street crossing and another near the mouth of the oxbow. For an impoundment alternative, there are additional choices related to how the structure can be operated, in order to optimize benefits to the habitat and/or the recreational interests. For purposes of this study, it was assumed that the impoundment structure would include an operable outlet control (variable stage stop logs), located downstream of Beach Street. This feature will provide for seasonal variations in desired pool elevation, as well as a means for at least partially draining the pool, if and when physical maintenance is required. Under any of the impoundment scenarios, the maximum anticipated pool elevation would range no higher than that which would be sustainable based on spillage from the current Trinity River channel. Due to the existing Beach Street bridge, it can be assumed that the potential, sustained pool elevations within the old Trinity River channel would range downward from 493 feet NGVD. The crest elevation of the Beach Street Dam is 494.5 - a series of 50 18-inch diameter corrugated pipes are mounted below the concrete crest, resulting in a normal pool elevation between 492 to 493 feet NGVD. At that maximum elevation, the surface area of the pool would be approximately 12 acres in size, with an overall average depth of about 4-5 feet (see table A-6). Depths along the centerline of the old river channel would be higher, especially adjacent to the impoundment structure. Any additional depth needed along the more upstream reaches of the project (for recreation purposes) could easily be obtained via minor trenching along the centerline of the old river channel. Existing invert elevations in that particular vicinity have risen since the time when the Trinity River channel was straightened, due to gradual sedimentation in that effectively stagnated zone.

Under the impoundment scenario(s) both localized runoff and sustained flows from the Trinity River would more than adequately service the wetland. Even in August, when the typical river flow rate drops to just a few cubic feet per second, there should be sufficient capability to provide for "active" flow along the oxbow. This type of alternative will obviously provide for both a more frequent and more substantial wetting of the lands along the old Trinity River channel.

The tabulated values represent 70 percent of the "Class A" pan evaporation documented by the NOAA at Bardwell Dam. The 70-percent adjustment is suggested for representing the more likely effects over larger ponded areas. Table A-7 indicates area evaporation data.

**TABLE A-7  
EVAPORATION DATA**

| Month     | Median Daily<br>Evaporation (inches) |
|-----------|--------------------------------------|
| January   | 0.07                                 |
| February  | 0.10                                 |
| March     | 0.14                                 |
| April     | 0.17                                 |
| May       | 0.19                                 |
| June      | 0.23                                 |
| July      | 0.26                                 |
| August    | 0.24                                 |
| September | 0.18                                 |
| October   | 0.14                                 |
| November  | 0.10                                 |
| December  | 0.07                                 |

Other plans were analyzed which considered additional tree plantings in the grassland areas - grasslands occupied with 25% trees and 100% trees. The increases on the water surface elevations are greater than the NER Plan (due to the additional roughness). The results of analysis are as follows:

**25 % trees:**

100-year flood event: up to 0.41 feet increase

SPF event: up to 0.44 feet increase

**100 % trees:**

100-year flood event: up to 0.83 feet increase

SPF event: up to 1.17 feet increase

Channel conveyance mitigation for these plans would require channel modification farther downstream of the NER Plan channel modification - in an area of the West Fork river channel dense with established trees. A channel modification to increase conveyance to offset the water surface elevation effects would require removal of a large number of these trees. Therefore no channel modification plans were developed.

## **CURRENT FLOODPLAIN HYDROLOGIC AND HYDRAULIC CRITERIA**

There are several hydrologic and hydraulic criteria that are applicable to proposed projects within the Upper Trinity River floodplain. These are as follows:

### **Fort Worth Floodway Criteria:**

Since the Fort Worth Floodway is located upstream of the project, no rise in the design flood water surface profile (SPF) is allowed.

### **The Corridor Development Certificate (CDC) Process Criteria:**

100-year flood - no rise in water surface profile, no loss of valley storage

SPF - no significant rise in water surface profiles, 5 percent loss of valley storage allowed

### **Section 404 Record of Decision:**

100-year flood: no rise in water surface profile, no loss of valley storage

SPF: no rise in water surface profiles, allowed 5 percent loss of valley storage